PROPAGATION OF SOME WOODY DESERT PERENNIALS BY STEM CUTTINGS

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Vegetatively propagated material provides an excellent control parameter in investigations of the effect of various environmental factors on plant growth. Clonal plants from a single ortet, grown under various natural or controlled environments, may be compared with some assurance that the elicited morphological or physiological differences are environmentally induced and not caused by genetic variation (Heslop-Harrison, 1964).

It is well known that desert succulents may be propagated by stem cuttings (many members of *Cactaceae)*, rhizomes (certain members of the genus *Yucca)*, or plantlets *(Agave* and *Kalanchoae)*. Little has been published, however, about vegetative propagation of woody desert perennials. Although a relatively recent report (Shreve, 1951) stated that *Fouquieria splendens* was the only woody perennial of the Sonoran Desert which could be propagated by stem cuttings, more recent work with *Chilopsis linearis* (Everett, 1957) and *Simmondsia chinensis* (Gentry, 1958) indicates that other desert shrubs may be propagated by stem cuttings.

The general lack of information concerning vegetative propagation of woody desert perennials prompted the testing of some predominant desert shrubs and trees to determine which propagating techniques could be used to obtain clonal material for a proposed comparative physiological-ecological analysis of desert perennials.

Stem cuttings from 11 woody perennial species (table 1) were collected near Palm Springs, California on March 7, 1965 and from nine species (table 2) on June 9, 1965. The cuttings were transported to the laboratory in plastic bags containing a little water.

The cuttings of each species of the first collection were divided into four equal lots, a fresh cut made, and the basipetal 1 inch placed in solutions of indole-3-acetic acid (IAA) for 24 hours (Audus, 1959). Two lots were treated with 200 ppm IAA, and one lot each with 100 and 300 ppm IAA.

The cuttings of one of the 200 ppm lots were suspended in an aerated nutrient solution (half-strength Hoagland's). The solution was changed weekly.

The remaining three lots were planted in vermiculite in a rooting box. All the cuttings were maintained on a 24 hour photoperiod (Lanphear and Meahl, 1961; Baker and Link, 1963), the natural light being supplemented by fluorescent bulbs. The intensity of the artificial light ranged from 150 to 200 ft-c at plant level. The rooting box was provided with bottom heat of 70° F by a thermistated heating tape (Audus, 1959).

TABLE 1. PERCENTAGE ROOTING OF CUTTINGS TAKEN MARCH 7. THE NUMBERS IN PARENTHESIS INDICATE THE NUMBER OF CUTTINGS IN EACH LOT

	IAA concentration		
Species	100 ppm	200 ppm	300 ppm
Acacia greggii Gray	0 (13)	0 (13)	0 (13)
Cercidium floridum Benth.	0 (20)	0 (20)	0 (20)
Dalea schottii Torr.	0 (20)	0 (20)	0 (20)
Encelia farinosa Gray #1	0 (10)	10 (10)	0 (11)
#2	82 (11)	72 (11)	70 (10)
Ephedra californica Wats.	0 (20)	0 (20)	0 (20)
Franseria dumosa Gray	33 (6)	0 (6)	33 (6)
Hymenoclea salsola T. & G.	78 (23)	95 (20)	95 (20)
Isomeris arborea Nutt.	0 (20)	0 (20)	0 (20)
Larrea divaricata Cav.	0 (20)	0 (20)	0 (20)
Prosopis juliflora D.C.	0 (15)	0 (10)	0 (14)
Simmondsia chinensis C. K. Schneid.	30 (20)	24 (20)	24 (20)

Each species of the second group of cuttings was divided into three lots. Two of the lots were placed in water for 24 hours while the remaining lot was soaked for 24 hours in IAA of 200 ppm. One of the water treated lots of each species was dipped in Rootone (Naphthylacetamide, 0.06%; 2-methyl-1-naphthylacetic acid, 0.033%; 2-methyl-1-naphthylacetamide, 0.013%; indole-3-butyric acid, 0.057%; inert ingredients, 99.85%), a commercial rooting powder, and the other lot was used as an untreated control. The cuttings were placed in the rooting box as outlined above. After rooting (48 days), the cuttings were transplanted into 4 inch pots in light greenhouse soil and returned to the rooting box to facilitate establishment.

The cuttings placed in the nutrient solution died within 30 days. No roots formed on any of the plants treated in this manner.

Daily maximum and minimum temperatures in the rooting box averaged 82 and 87 and 64 and 62 F during the first and second treatment periods respectively. The average maximum relative humidity was 86 and 85 per cent, and the average minimum relative humidity was 59 and 60 per cent during the first and second periods respectively.

In the first test, the percentage of rooting was high in *Hymenoclea salsola* and *Encelia farinosa* and fairly high in *Franseria dumosa* and *Simmondsia chinensis* (table 1). In this test, all of the cuttings of a species came from a single individual with the exception of *Prosopis juliflora* and *Encelia farinosa*. The cuttings of *Prosopis* were taken from eight plants, those from *Encelia* from two plants in the same stage of flowering, growing less than 10 ft apart. Only 1 of 31 cuttings of one shrub rooted while 24 of 32 cuttings of the neighboring bush formed roots, indicating the possibility of intraspecific physiological or genetic variation in the rooting response. Consequently, a random sampling technique, in which cuttings were taken from several plants, was employed in the second test.

Table 2. Percentage Rooting of Cuttings Taken June 9. The Numbers in Parenthesis Indicate the Number of Cuttings in the Lot

Species	control	Rootone	200 ppm IAA
Acacia greggii Gray	0 (3)	0 (4)	0 (4)
Chilopsis linearis Sweet.	83 (6)	100 (5)	0 (5)
Dalea schottii Torr.	0 (10)	0 (10)	20 (10)
Franseria dumosa Gray	50 (10)	70 (10)	50 (10)
Hymenoclea salsola T. & G.	20 (10)	10 (10)	80 (10)
Isomeris arborea Nutt.	0 (10)	50 (10)	0 (10)
Peucephyllum schottii Gray	14 (7)	100 (8)	33 (6)
Pluchea sericea Gove.	20 (10)	0 (10)	20 (10)
Simmondsia chinensis C. K. Schneid.	10 (10)	0 (10)	10 (10)

The second group of cuttings was taken to determine the relative values of IAA and Rootone as rooting hormones. In this test, *Chilopsis linearis, Franseria dumosa, Hymenoclea salsola,* and *Peucephyllum schottii* rooted well. *Dalea schottii, Isomeris arborea, Pluchea serica* and *Simmondsia chinensis* showed some degree of root formation (table 2). *I. arborea* and *D. schottii* had not rooted in the previous test.

The success with Rootone as a rooting substance and the relative ease of its application has precluded further work with IAA. *Hymenoclea salsola* is the only species that responded significantly better to IAA than to the commercial rooting powder.

Conclusions

1. Stem cuttings of many woody desert perennials can be induced to form roots, contrary to an earlier report (Shreve, 1951).

2. For most of the shrubs which rooted, maintenance of Rootone treated cuttings in a rooting box under continuous light with moderate bottom heat provides an acceptable percentage of rooting.

3. Treatment with 200 ppm indole-3-acetic acid may enhance rooting in cuttings which respond poorly to Rootone.

4. Some species, however, *(Acacia greggii, Cercidium floridum, Ephedra californica, Larrea divaricata* and *Prosopis juliflora)* did not root under any of our treatments.

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NOTES ON THE HORDEUM JUBATUM COMPLEX

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Mitchell and Wilton (1964) examined the *jubatum-caespitosum-brachyantherum* complex in Alaska. Their report contains interesting information on the behaviour of the complex at the northern border of the North American population. They concluded that there is "little support for combining the Alaskan populations of *H. brachyantherum* with *H. jubatum*." If the word "Alaskan" is omitted then the conclusion is at variance with the one suggested by Rajhathy and Morrison (1959; 1961) and with the taxonomic treatment of this group by Bowden (1962). Although Mitchell and Wilton dealt with Alaskan populations which are only a small peripheral fraction of the whole North American population, they generalize from their data and propose to maintain species status for both *jubatum* and *brachyantherum*. Since in their generalization they disregard a mass of evidence obtained on the populations of the Canadian and American West and Midwest as well as in the experimental garden, a brief discussion of the problem seems to be warranted. This paper is contribution No. 139 from the Research Station, Canada Department of Agriculture, Central Experimental Farm, Ottawa.

Species relationships should be assessed in the light of the biological species concept. Thus, interbreeding should be recognized as the main criterion of conspecific status. Mitchell and Wilton stated that *H. brachyantherum* and *H. jubatum* fail to "hybridize on many sites where they are in contact." This appears to be the case in Alaska. Although they located a few hybrid populations, their future remains doubtful. The authors may be right because the extreme environment of Alaska may not provide the ecological niche for successful competition or introgression. However, even if this were the case, generalizing from a specialized peripheral situation cannot be considered valid. When interbreeding between two species populations is examined surely greater significance should be assigned to those sites where hybridization does occur than to those where it does not. Large hybrid swarms exist in the Canadian and American West and Midwest. These became well established also in areas such as Saskatchewan and Manitoba where only *H. jubatum* occurs and *brachyantherum* is absent (Bowden, 1962). Thus, they not only maintain themselves but also migrate from the original sites.